

HS-RN

4-Channel Low Speed Data Module

Megaplex-2100/2104 Version 12.6, Megaplex-4100 Version 2.0



data communications

The Access Company

HS-RN

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Megaplex-2100/2104 Version 12.6, Megaplex-4100 Version 2.0

Installation and Operation Manual

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Quick Start Guide

If you are familiar with the HS-RN module, use this guide to prepare it for operation.

1. Preparation for Operation

Insert the module in the prescribed I/O slot.

Connect the prescribed cables to the module CH connectors, in accordance with the site installation plan.

2. Configuration Procedure

- To configure the desired HS-RN channel in the MP-2100/2104 chassis:

Use the command:

```
DEF CH SS CC
```

where **ss** is the slot number, and **cc** is the channel number (1 to 4).

- To configure the desired HS-RN channel in the MP-4100 chassis:

Use the **Configuration>Physical Layer>I/O** screen.

Configuration parameters and the range of values are listed in the following table.

Parameter	Range of Values
Connect*	YES
	NO
Admin Status**	UP
	DOWN
Bus Connection*	FULL
	PARTIAL
Encapsulation Mode	Bandwidth Optimized
	Latency Optimized
Format	ASYNC (Default with MP-2100)
	SYNC (Default with MP-4100)

Parameter	Range of Values
Rate	ASYNC: 0.6 , 1.2, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4 kbps SYNC: 0.6 , 1.2, 2.4, 4.8, 7.2, 9.6, 14.4, 19.2, 28.8, 38.4, 56, 64 kbps
CTS	ON RTS
DCD & DSR	LOCAL END-TO-END
Data Bits (ASYNC only)	5 BITS (MP-2100) 6 BITS 7 BITS 8 BITS (MP-4100)
Parity (ASYNC only)	YES NO
Stop Bits (ASYNC only)	1 2
Clock Mode (SYNC only)	DCE EXT DCE
Oper Mode	BI-DIR UNI-BRD TX UNI-BRD RX BID-BRD RX*
ML Slot*	IO-1 up to the maximum supported by the chassis
ML Channel*	EX1 up to the maximum supported by the selected main link module
Link to Slot**	CL.1, IO-1 to IO-10
Link to Port**	1 to 8 for external ports 1 to 63 (1 to 84) for internal (virtual) PDH ports NONE
Map Type	N/A USER SEQUENCE

Parameter	Range of Values
Start TS	N/A 1 to 31 for E1 links 1 to 24 for T1 links

* MP-2100/2104 only

** MP-4100 only

3. Assigning Timeslots

Assign the uplink bandwidth to each connected channel as follows:

- When using the **BI-DIR** or **UNI-BRD TX** mode in the module installed in the MP-2100/2104 chassis, use the **DEF TS** command to assign a timeslot and the **DEF SPLIT TS A:B:C** command to assign a fraction of a timeslot as explained in the [Megaplex-2100/2104 Installation and Operation Manual](#). For the module installed in the MP-4100 chassis, use the **Configuration > System > TS Assignment** screen.
- When using the **UNI-BRD RX** or **BID-BRD RX** mode in the module installed in the MP-2100/2104 chassis, timeslot assignment for the receive direction is made using the dedicated routing fields of the **DEF CH** command. For the module installed in the MP-4100 chassis, use the **Configuration > Physical Layer > IO** screen.

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Chapter 1

Introduction

1.1 Overview

This manual describes the technical characteristics, applications, installation and operation of the HS-RN four-channel low-speed data modules for use in Megaplex-2100, Megaplex-2104, and Megaplex-4100 integrated access multiplexers.

HS-RN modules provide functionality similar to that offered by the HS-R modules long available from RAD, but use improved hardware that can utilize all the four TDM buses in the chassis (a capability supported only by Megaplex units equipped with CL.2 modules and running software version 11.0 and higher).

Product Options

Two module versions are offered:

- **HS-RN:** a proprietary HDLC-protocol based module version featuring Bandwidth and Latency optimization.
- **HS-RN/V.110:** a special version for operation in the V.110 mode, fully compatible with the old HS-R module.

Note *In this manual, the following generic terms are used:*

- The term **HS-RN** is used when the information is applicable to both the HS-RN and HS-RN/V.110 modules.
- The term **Megaplex** is used when the information is applicable to all the three Megaplex chassis.

The complete designation is used only for information applicable to a specific equipment version.

Main Features

The HS-RN modules provide four independent V.24/RS-232 channels with DCE interfaces that support full duplex asynchronous and synchronous data transmission in the range of 0.6 through 64 kbps. The supported data rates depend on the HS-RN model and encapsulation method (see [Table 1-1](#)).

Each channel has local support of RS-232 control signals. Alternately, each channel can be configured to transmit RS-232 control signals end-to-end (this is possible at all the rates, except for 56 and 64 kbps):

- The local DTR state determines the remote DSR state, and vice versa
- The local RTS state determines the remote DCD state, and vice versa.

Basically, each HS-RN channel is assigned an individual timeslot in the E1, T1 or SDH/SONET uplink. The HS-RN modules also support split timeslot assignment, therefore improving uplink bandwidth utilization.

The user can assign the timeslots and timeslot bits to HS-RN channels manually. User-controlled manual timeslot assignment allows routing the bit stream generated by each local channel to any other compatible Megaplex channel at the remote site.

In addition to the normal full-duplex (bidirectional) mode, HS-RN supports additional transmission modes, which enable point-to-multipoint communication:

- Unidirectional (simplex) transmission, where each channel can be configured either to receive (unidirectional RX) or transmit (unidirectional TX).
- Bidirectional broadcast (half-duplex) communication, suitable for polled applications. In this mode, a channel can either transmit or receive, but not both simultaneously (the direction of transmission is determined by the state of the local RTS line). This mode is not supported by the Megaplex-4100 chassis.

For a description of these modes, see the corresponding *Megaplex Installation and Operation Manual*.

The operation mode of each channel is independently selectable, using the Megaplex management system or a supervision terminal.

The HS-RN modules perform rate adaptation using a proprietary HDLC-based protocol, while the HS-RN/V.110 modules perform rate adaptation in accordance with ITU-T Rec. V.110. Multiplexing in both models is performed in accordance with ITU-T Rec. I.460.

1.2 Applications

Low-Speed Data Connectivity

Figure 1-1 shows a typical point-to-point low-speed data transmission application using HS-RN modules.

In this application, two HS-RN modules are used to connect remote terminals to a server or communication controller through the Megaplex link. Each channel can be connected to a different destination.

The HS-RN modules enable efficient utilization of link bandwidth; for example, a HS-RN module enables the transmission of all the four 9.6 kbps channels in one 64 kbps timeslot (see *Section 1.4* for additional details).

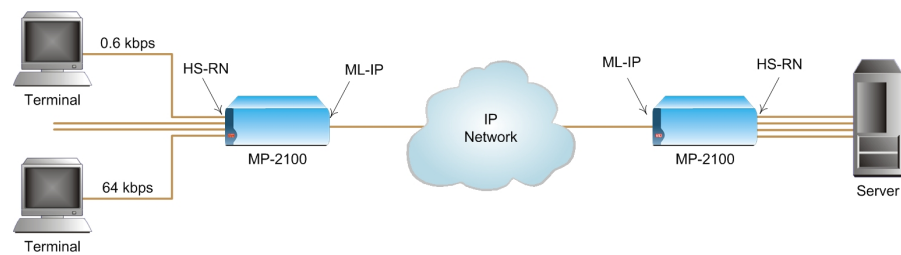


Figure 1-1. Low-Speed Data Connection

Figure 1-2 shows a typical Point-to-Multipoint application.

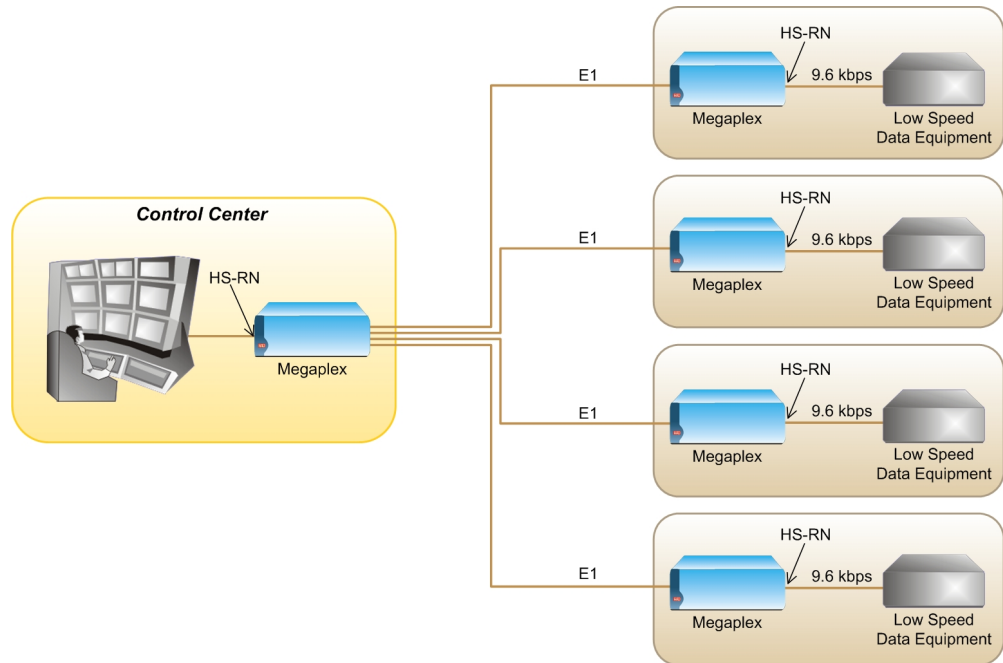


Figure 1-2. Point-to-Multipoint Connectivity at Low Speed Data Transfer

Unidirectional Broadcast Mode Applications

The unidirectional broadcast mode enables a user at a central location to send data to multiple users connected to remote Megaplex units (simplex communication), while using only one timeslot.

In this mode, any message is simultaneously received by all the unidirectional users, but none of them can send back data to the originator.

This capability is achieved by separating the handling of the receive and transmit paths in the timeslot assigned for the unidirectional channels, as shown by the dashed lines within the Megaplex units in Figure 1-3.

Figure 1-3 shows a network that uses the unidirectional broadcast mode to distribute data from a central location (A) to several remote locations (B, C, D, etc.). In Figure 1-3, the user at the central location (A) is connected to an HS-RN channel configured for operation in the unidirectional transmit mode. The channels of the remote users (at locations B, C, D) are configured for the unidirectional receive mode.

The timeslot assigned to user A on one of the internal TDM buses is routed to the two main link ports of the Megaplex unit at location A, and can be inserted in timeslots with different numbers.

For simplicity, first the path to the user at location D is described:

- In the forward path (from location A to D), the timeslot assigned to the HS-RN channel configured for unidirectional transmit operation is routed through the desired timeslot of port 1 to the Megaplex unit at location D.

At location D, the timeslot is routed to the HS-RN channel is routed to the receive path of the unidirectional receive HS-RN channel. Therefore, the user D receives data sent by user A.

- In the reverse path (from location D to A), the timeslot is always disconnected. Therefore, the user D cannot transmit data to user A.

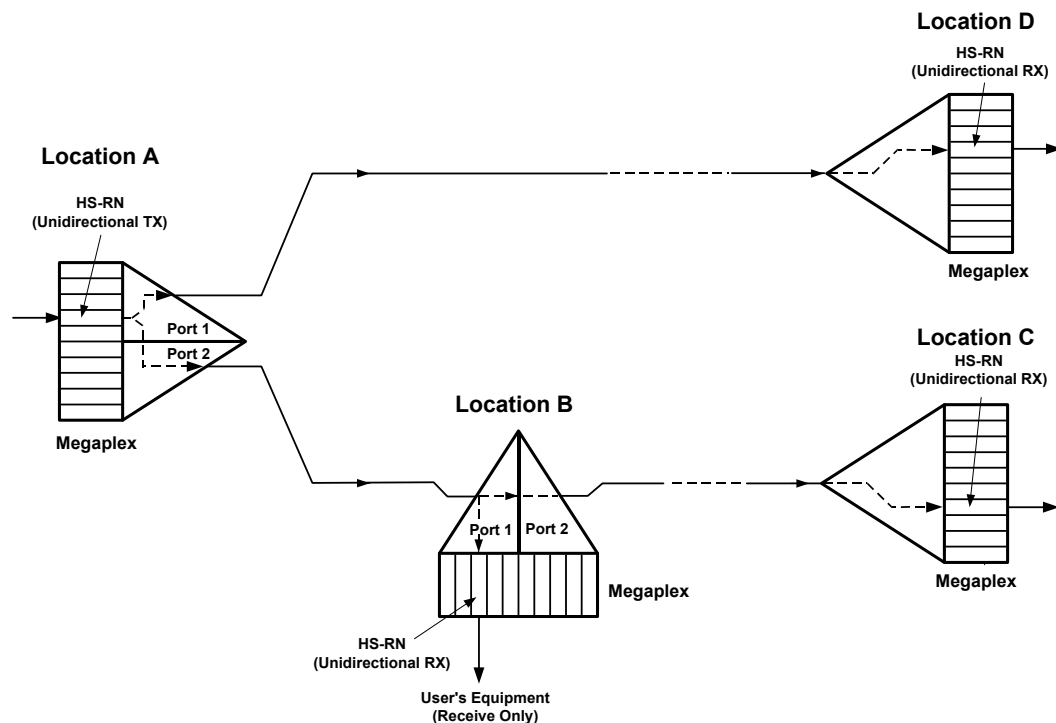


Figure 1-3. Typical Unidirectional Broadcast Application

The path to the users B and C is as follows:

- In the forward path (from location A to B, C, etc.), the timeslot assigned to the HS-RN channel configured for unidirectional transmit operation is routed through the desired timeslot of port 2 to the Megaplex unit at location B.

At location B, the timeslot received at port 1 is routed as follows:

- To the receive path of user B, configured for unidirectional receive operation
- To the desired timeslot of port 2 (bypassing), which is connected to the Megaplex at location C.

Therefore, the transmit signal of user A is relayed to the following units, and the user B receives data sent by user A.

Note

The timeslot can be connected in parallel to any number of channels.

- In the reverse path (to location A), the timeslot is always bypassed from port 2 to port 1, en route to location A.

To prevent interference from the unidirectional channel, its transmit path is always disconnected from the main link timeslots (at location B, no information is inserted in the timeslot bypassed from port 2 to port 1), and user B cannot transmit data to any other user. The same is true for the user at location C.

Figure 1-4 shows another network configuration, which enables regular (full duplex, or bidirectional) communication between two users (the users at locations A and C), and in addition enables the monitoring of the data sent by the user at location A at location B.

For this configuration, the users A and C are configured as regular users, and the user at location B is configured for unidirectional receive operation.

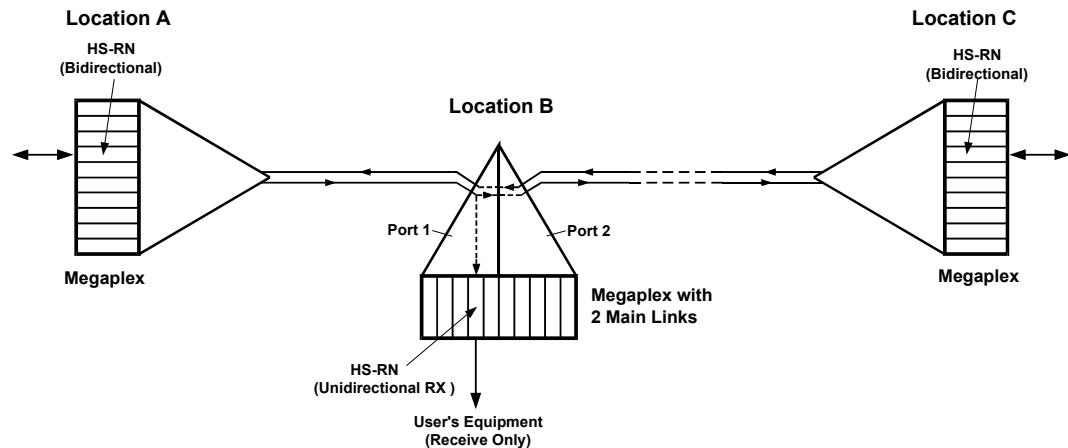


Figure 1-4. Typical Unidirectional Receive Application

Bidirectional Broadcast Mode Applications (MP-2100/2104)

The bidirectional broadcast mode enables a user at a central location to communicate half-duplex with several users connected to remote Megaplex units.

Figure 1-5 shows a network topology which uses the bidirectional broadcast capability.

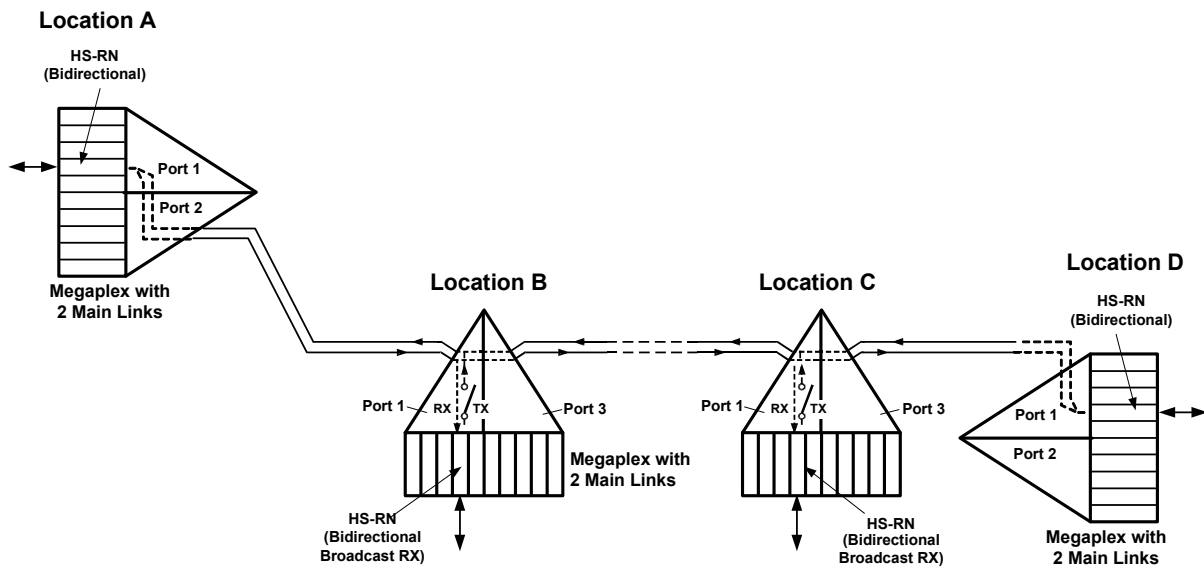


Figure 1-5. Typical Bidirectional Broadcast Application

The broadcast capability is achieved by separating the handling of the receive and transmit paths for the timeslots assigned for the broadcast channels, as shown by the dashed lines within the Megaplex units in [Figure 1-5](#).

Note *The bidirectional broadcast mode is not available for the module operating in the Megaplex-4100 chassis.*

The user at the central location is configured to use the regular (bidirectional) mode, and therefore it can both transmit and receive. The other users are configured to use the bidirectional broadcast receive (BID BRD RX) mode: this mode is similar to the unidirectional receive mode, except that at any time one of these users (and only one) can transmit to (and be received by) user A. This mode of operation is used in polled applications.

In the application shown in [Figure 1-5](#), the handling of the signals generated by user A is similar to that for the unidirectional transmit mode described above. The difference is that each broadcast user can insert its signal in the receive timeslot that reaches user A (instead of the signal bypassed from the other link). The change in routing is controlled by the RTS signal in the data connector of the HS-RN module:

- When the RTS signal is not active (idle state), the receive timeslot is bypassed from link B to link A, and continues toward user A.
- When the RTS signal is asserted, the receive timeslot of link B is disconnected from link A, and the transmit path of the local broadcast user is connected to link A.

Thus, user A can request any user to answer, and that user can assert its RTS line and thus connect to user A. At any time, only one user may transmit toward user A (if more than one user transmits, only the user closest to location A will actually be received). When using the bidirectional broadcast receive mode, it is necessary to instruct each main link port how to handle the traffic flow information. This is performed by defining the timeslot type, as part of the DEF TS command (see [Megaplex-2100/2104 Installation and Operation Manual](#)).

1.3 Physical Description

The HS-RN is a 4U-high module that occupies one I/O module slot in the Megaplex chassis. All the functional configuration parameters of the modules are determined by software. Jumpers are used only to control the connection of ground reference to each channel connector.

Figure 1-6 shows a typical HS-RN panel.

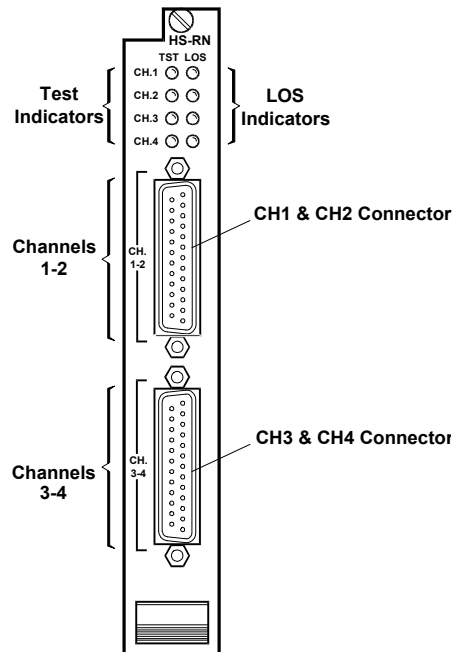


Figure 1-6. Typical HS-RN Module Panel

The HS-RN panel includes two status indicators for each channel:

- **TST** (yellow): lights up when a test or loopback is activated on the corresponding channel.
- **LOS** (red): lights up when the main link loses synchronization or the corresponding channel loses protocol synchronization to the remote end (not used for the rates of 64 kbps and 56 kbps)

When a channel is not connected, its LOS indicator is always off.

The HS-RN module panel also includes two 25-pin D-type female connectors, each serving two channels.

1.4 Functional Description

Functional Block Diagram

The functional block diagram of the HS-RN module is shown in [Figure 1-7](#).

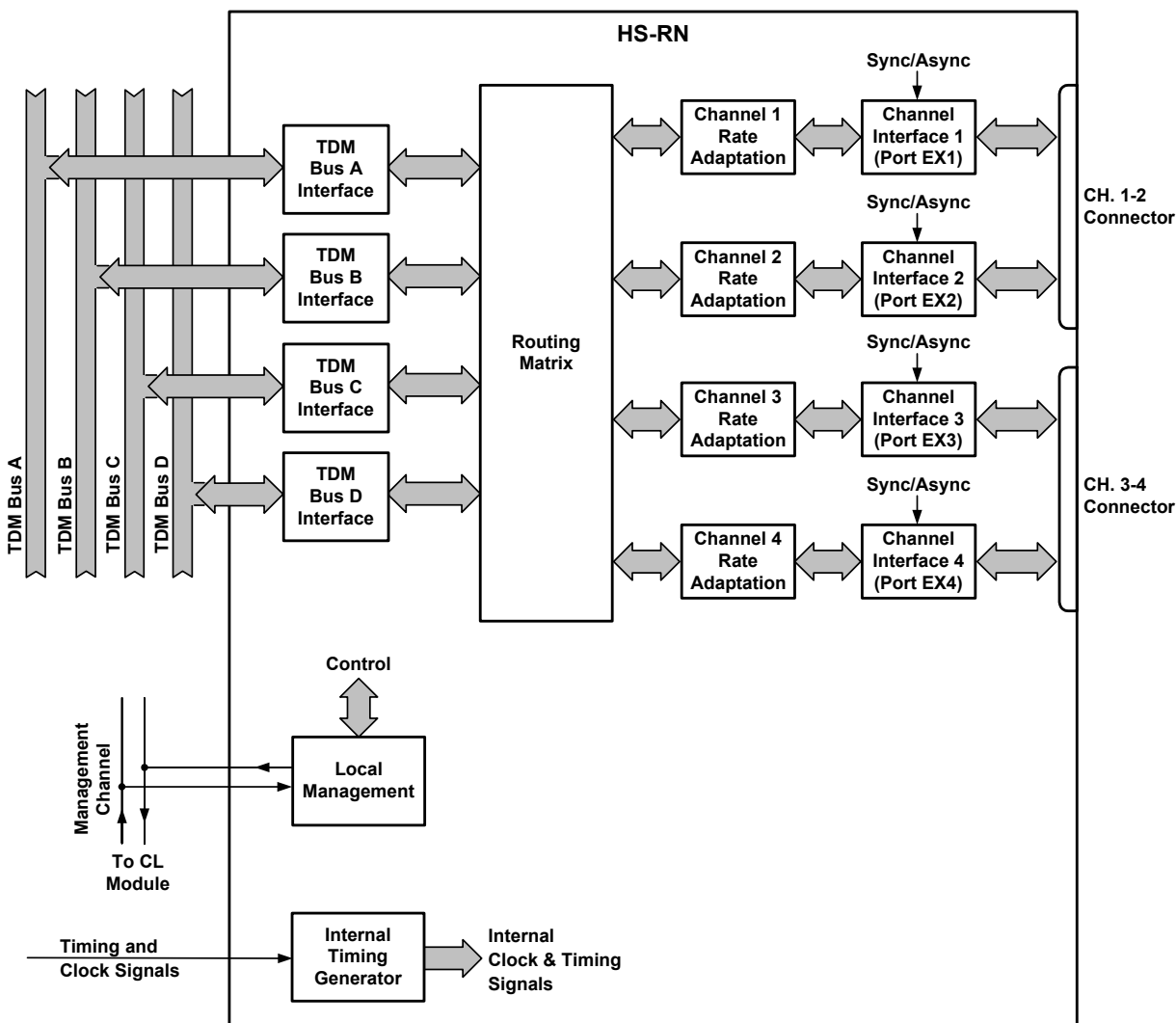


Figure 1-7. Module HS-RN, Functional Block Diagram

The HS-RN module includes the following main subsystems:

- TDM bus interfaces
- Routing (cross-connect) matrix
- Channel rate adaptation processor
- Channel interfaces
- Timing subsystem
- Local management subsystem.

TDM Bus Interfaces (Megaplex-2100/2104 only)

The HS-RN module has four independent TDM bus interfaces, one for each Megaplex-2100/2104 TDM bus. Each TDM bus interface is used to connect timeslots from the corresponding bus to the internal routing matrix of the HS-RN module, in accordance with the commands received from the CL module.

HS-RN can use all the four TDM buses. However, when necessary the Megaplex-2100/2104 user can configure it to use only two TDM bus interfaces, irrespective of the number of TDM buses used in the Megaplex-2100/2104 chassis.

Note

The default number of TDM buses used in the MP-2100/2104 chassis is 4. The number can be reduced by means of the SET USER command. The HS-RN module can be configured to use all the four TDM buses only when the number of MP-2100/2104 TDM buses has not been reduced.

Routing Matrix

The HS-RN module includes a routing matrix that controls the routing of the module channels to the desired Megaplex main link ports, via the TDM buses.

The matrix also supports split timeslot routing: it enables inserting any channel not requiring a full timeslot in any position of a desired timeslot (see number of required bits versus channel data rate in [Table 1-2](#)).

Matrix routing is controlled by the CL module, and enables connecting any TDM bus timeslot to any channel. The routing matrix also supports unidirectional routing of timeslots, and broadcasting from one timeslot to multiple destinations (refer to the corresponding [Megaplex Installation and Operation Manual](#) for details).

Encapsulation Mode

In the HDLC module version, the module encapsulation mode can be optimized according to the user application as follows:

- **Bandwidth Optimized** – enables uplink bandwidth optimization (using split timeslots) in applications less sensitive to latency.
- **Latency Optimized** – enables minimum end-to-end data latency. In this mode split timeslots are not available, and the uplink bandwidth should be always transferred over full 64 kbps timeslot per channel.

In the V.110 module version, the module operates in **Bandwidth Optimized** mode only, but the end-to-end data latency is at minimum.

Note

A pair of HS-RN modules can operate together only if set to the same mode (HDLC/BO, HDLC/LO or V110).

Channel Rates

Table 1-1 lists the HS-RN data rates available in the V.110 and HDLC operating modes.

Table 1-1. HS-RN Channel Rates in HDLC and V.110 Operating Modes

Channel Rate	HDLC - Bandwidth Optimized		HDLC - Latency Optimized		V.110	
	Sync	Async	Sync	Async	Sync	Async
0.6 kbps	√	√	√	√	√	√
1.2 kbps	√	√	√	√	√	√
2.4 kbps	√	√	√	√	√	√
4.8 kbps	√	√	√	√	√	√
7.2 kbps	√	√	√	√		
9.6 kbps	√	√	√	√	√	√
14.4 kbps	√	√	√	√		
19.2 kbps	√	√	√	√	√	√
28.8 kbps	√	√				
38.4 kbps	√	√			√	√
56 kbps	√				√	
64 kbps	√				√	

Channel Rate Adaptation Processor

Rate adaptation is needed at all the channel rates, except 56 and 64 kbps. Each channel has its own channel rate adaptation processor, which is used to adapt the user's payload data rate to a multiple of 16 kbps (16 kbps, or two bits, is the main link bandwidth allocation unit).

The difference between the assigned and payload bandwidth also enables end-to-end transfer of RS-232 interface signal states, when a channel is configured to support this service.

Table 1-2 lists the supported user's payload data rates, the data rate obtained after rate adaptation, the number of main link bits assigned by the HS-RN channel to carry the channel payload data, and the corresponding fraction of main link timeslot for each data rate.

Note

When a channel operates in any one of the broadcast modes or latency optimization mode, it must be assigned a full main link timeslot, although it may not utilize the full timeslot bandwidth.

To assign a fraction of a timeslot for the module installed in the MP-2100/2104 chassis, use a **DEF SPLIT TS A:B:C** command, as explained in the [Megaplex-2100/2104 Installation and Operation Manual](#). For the module installed in the MP-4100 chassis, use the **Configuration > System > TS Assignment** screen.

For completeness, [Table 1-2](#) also lists rates at which rate adaptation is not needed (56 and 64 kbps).

Table 1-2. Occupied Bandwidth versus Channel Rate

Channel Rate	Occupied Bandwidth	Number of Bits
0.6 kbps	16 kbps	2 (one-quarter timeslot)
1.2 kbps	16 kbps	2 (one-quarter timeslot)
2.4 kbps	16 kbps	2 (one-quarter timeslot)
4.8 kbps	16 kbps	2 (one-quarter timeslot)
7.2 kbps	16 kbps	2 (one-quarter timeslot)
9.6 kbps	16 kbps	2 (one-quarter timeslot)
14.4 kbps	32 kbps	4 (one-half timeslot)
19.2 kbps	32 kbps	4 (one-half timeslot)
28.8 kbps	64 kbps	8 (one timeslot)
38.4 kbps	64 kbps	8 (one timeslot)
56 kbps (SYNC mode only)	64 kbps	8 (one timeslot)
64 kbps (SYNC mode only)	64 kbps	8 (one timeslot)

Channel Interface

Channel Interface Functions

Each HS-RN module channel can be configured by the user for asynchronous or synchronous operation. Each channel has a DCE RS-232 interface.

The channel interface provides the following functions:

- Conversion of data stream received from the link to the format needed by the user's equipment, and vice versa. This conversion depends on the operation mode (synchronous/asynchronous; for the latter, it also depends on the selected word format.
- Physical interfacing to the user's equipment, including handling of RS-232 interface signals.

Asynchronous Mode

The data rates supported by both HS-RN models in the asynchronous mode are 0.6, 1.2, 2.4, 4.8, 9.6, 19.2, and 38.4 kbps. The HDLC model additionally features the data rates of 7.2, 14.4 and 28.8 kbps.

In the asynchronous mode, the user can specify the structure of the word format to be processed by each channel (this structure must be identical to that used by the user's equipment).

The available options are as follows:

- Number of data bits: 5, 6, 7, or 8.

- Use of parity: if the user's data word format includes a parity bit, the user can enable transparent end-to-end transfer of the original parity bit. The HS-RN module itself does not check the parity of the incoming data.
- Number of stop bits: 1 or 2.

In addition to the selected parameters, the word format includes one start bit.

Note *When setting the Async Mode parameters, pay attention to the total character length calculated by the formula: **$M = \text{data bits} + \text{parity} + 1 \text{ start bit} + \text{stop bits}$** . This length can be set to 8,9,10, or 11. The numbers out of this range are not supported.*

Synchronous Mode

The data rates supported by both HS-RN models in the synchronous mode are 0.6, 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 56 and 64 kbps. The HDLC model additionally features the data rates of 7.2, 14.4 and 28.8 kbps.

Interface Control Lines

The RS-232 interface control signals are locally supported in accordance with the RS-232 protocol, with the following modifications:

- The DSR line is continuously active (ON), except when the end-to-end transmission of control signals is enabled.
- The DCD line is ON only when both the channel framing machine and the local Megaplex main link carrying the channel are synchronized, and is OFF when either the channel framing machine or the main link loses synchronization.
- For flexibility in application, the user can program the state of the CTS line. The available selections are:
 - The CTS line is continuously active (ON).
 - The state of the local CTS line tracks the state of the local RTS line.

As an alternative to local support as described above, the user can enable end-to-end transmission of the states of the local DTR and RTS lines to the remote DSR and DCD lines, respectively. Note that end-to-end transmission of control signals is not supported at the 56 and 64 kbps channel rates.

Timing

When operating in the synchronous mode, the timing of the HS-RN channel interfaces is locked to the Megaplex nodal timing.

The timing mode of each HS-RN module channel can be selected by the user. Two options are available:

- **DCE:** the interface provides transmit and receive clock signals to the user's data equipment (DTE). The user's DTE must receive and transmit at the rate of the clock signals provided by the HS-RN channel interface.
- **EXT DCE:** the interface provides a receive clock signal to the user's DTE, and accepts the transmit clock from the user's DTE. The user's DTE must operate with loopback timing; that is, it must transmit at the rate of the receive clock

signal provided by the HS-RN channel interface. This timing mode is suitable for tail-end applications.

Configuration and Management

All the module operating parameters are controlled by means of the Megaplex system management. The flexible timeslot routing capabilities of the Megaplex systems enable the user to select the timeslots assigned to HS-RN channels on the E1/T1/SDH/SONET uplinks, in order to route the bit stream generated by the multiplexing process described above in each local channel.

Each main link allocation unit generated by an HS-RN module can be independently routed to any other compatible module installed in the remote Megaplex unit, configured for the same combination of data rates. Moreover, the HS-RN modules support split timeslot allocation.

Diagnostics

The HS-RN modules support self-diagnostics upon power-up, as well as powerful testing capabilities controlled by means of the system management functions.

The test and loopback functions, that can be individually activated by the system management functions for each module channel, include:

- Local digital loopback.
- Remote digital loopback.

1.5 Technical Specifications

General	<i>Number of data channels</i>	Four
	<i>Channel interface</i>	ITU-T Rec. V.24/V.28, EIA RS-232
	<i>Interface type</i>	DCE
	<i>Signal format</i>	Asynchronous or synchronous, user-selectable
Number of TDM Buses in MP-2100/2104	2 or 4, user selectable (4 buses are supported only by Megaplex-2100/2104 units equipped with CL.2 modules and running software version 11.0 and higher)	

Data Transmission Characteristics	<i>Asynchronous mode</i>	0.6, 1.2, 2.4, 4.8, 7.2*, 9.6, 14.4*, 19.2, 28.8*, 38.4 kbps
	<i>Synchronous mode</i>	0.6, 1.2, 2.4, 4.8, 7.2*, 9.6, 14.4*, 19.2, 28.8*, 38.4, 56, 64 kbps
		Notes: 1. The rates marked by asterisk (*) are supported in the HDLC model only. 2. When Encapsulation mode is "Latency optimized", only rates up to 19.2 are supported.
	<i>Asynchronous character format</i>	User-selectable
	<i>Start bits</i>	1
Interface Control Signals	<i>Data bits</i>	5, 6, 7, or 8
	<i>Parity</i>	Enable/disable transparent end-to-end transfer of parity bit
	<i>Stop bits</i>	1 or 2
	<i>Support modes</i>	<ul style="list-style-type: none"> Local support End-to-end transfer (not available for rates of 56 and 64 kbps)
	<i>Local support</i>	<ul style="list-style-type: none"> DSR always ON when module is powered (unless end-to-end transmission is enabled) Local DCD is ON when the main link is synchronized and there is no SYNC LOSS alarm on the channel Local CTS tracks local RTS state, or is constantly ON (user-selectable)
Timing	<i>End-to-end transfer (user-selectable)</i>	<ul style="list-style-type: none"> Local DTR line to remote DSR line Local RTS line to remote DCD line
	<i>Timing source</i>	RS-232 interface timing locked to nodal timing
	<i>Timing modes</i>	<ul style="list-style-type: none"> DCE: Transmit and receive clocks to DTE External DCE: Receive clock to DTE, transmit clock from DTE
Main Link Bandwidth		<ul style="list-style-type: none"> 2 bits for 0.6, 1.2, 2.4, 4.8, 7.2, 9.6 kbps 4 bits for 14.4, 19.2 kbps 8 bits for 28.8, 38.4, 56, 64 kbps (one timeslot per channel)

Indicators	<i>LOS indicator (per channel)</i>	Lights up when the main link loses synchronization or the corresponding channel loses protocol synchronization to the remote end (not used for the rates of 56 and 64 kbps)
	<i>TEST indicator (per channel)</i>	Lights up when a loopback is activated on the corresponding channel
Diagnostics	<i>Loopbacks</i>	<ul style="list-style-type: none">• Local loopback• Remote loopback
Connectors		Two 25-pin D-type female connectors (one connector for each pair of channels)
Configuration		Programmable by the Megaplex system management

Chapter 2

Installation and Operation

2.1 Introduction

This chapter provides installation and operation instructions for the HS-RN modules.

The information presented in this chapter supplements the general Megaplex installation, configuration and operation instructions contained in the corresponding *Megaplex Installation and Operation Manual*.



Before performing any internal settings, adjustment, maintenance, or repairs, first disconnect all the cables from the module, and then remove the module from the Megaplex enclosure.

No internal settings, adjustment, maintenance, and repairs may be performed by either the operator or the user; such activities may be performed only by a skilled technician who is aware of the hazards involved.

Always observe standard safety precautions during installation, operation, and maintenance of this product.

Caution

The HS-RN module contains components sensitive to electrostatic discharge (ESD). To prevent ESD damage, always hold the module by its sides, and do not touch the module components or connectors.

2.2 Installing the Module in the Chassis

The HS-RN modules can be installed in an operating chassis (hot insertion).

For general installation procedures and safety instructions, refer to the *Megaplex-2100/2104 Installation and Operation Manual* or *Megaplex-4100 Installation and Operation Manual*.

Insert the HS-RN module in the prescribed I/O slot and fasten it with its two screws.

The module starts operating as soon as it is plugged into an operating Megaplex enclosure.

2.3 Connecting the Cables

Connection Data

Connector Pin Assignment

The connection of user's equipment to HS-RN modules is made to the two 25-pin D-type female connectors designated CH. 1-2 and CH. 3-4. [Table 2-1](#) lists the pin assignment of the CH. 1-2 connector, which serves channels 1 and 2. The wiring of the CH. 3-4 connector, which serves channels 3 and 4, is similar.

Table 2-1. CH. 1-2 Connector, Pin Assignment

Pin	Designation	Direction	Function
1	FGND	–	Frame ground (connected through jumper)
2	TD1	IN	TX data, channel 1
3	RD1	OUT	RX data, channel 1
4	RTS1	IN	Request to send, channel 1
5	CTS1	OUT	Clear to send, channel 1
6	DSR1	OUT	Data set ready, channel 1
7	SGND	–	Signal ground
8	DCD1	OUT	Carrier detect, channel 1
9, 10	–	–	Not used
11	TXCLK2	OUT	TX clock, channel 2
12	DCD2	OUT	Carrier detect, channel 2
13	CTS2	OUT	Clear to send, channel 2
14	TD2	IN	TX data, channel 2
15	TXCLK1	OUT	TX clock, channel 1
16	RD2	OUT	RX data, channel 2
17	RCLK1	OUT	RX clock, channel 1
18	RCLK2	OUT	RX clock, channel 2
19	RTS2	IN	Request to send, channel 2
20	DTR1	IN	Data terminal ready, channel 1
21	DSR2	OUT	Data set ready, channel 2
22	–	–	Not used
23	TXCLK-EXT2	IN	External TX CLK, channel 2
24	TXCLK-EXT1	IN	External TX CLK, channel 1
25	DTR2	IN	Data terminal ready, channel 2

Cable Data

RAD offers two channel splitter cables that enable direct connection of data equipment with RS-232 interfaces to an HS-RN channel connector:

- CBL-HSR/F, which terminates into two 25-pin D-type female connectors.
- CBL-HSR/M, which terminates into two 25-pin D-type male connectors.

The wiring diagram of the two cables is shown in [Figure 2-1](#).

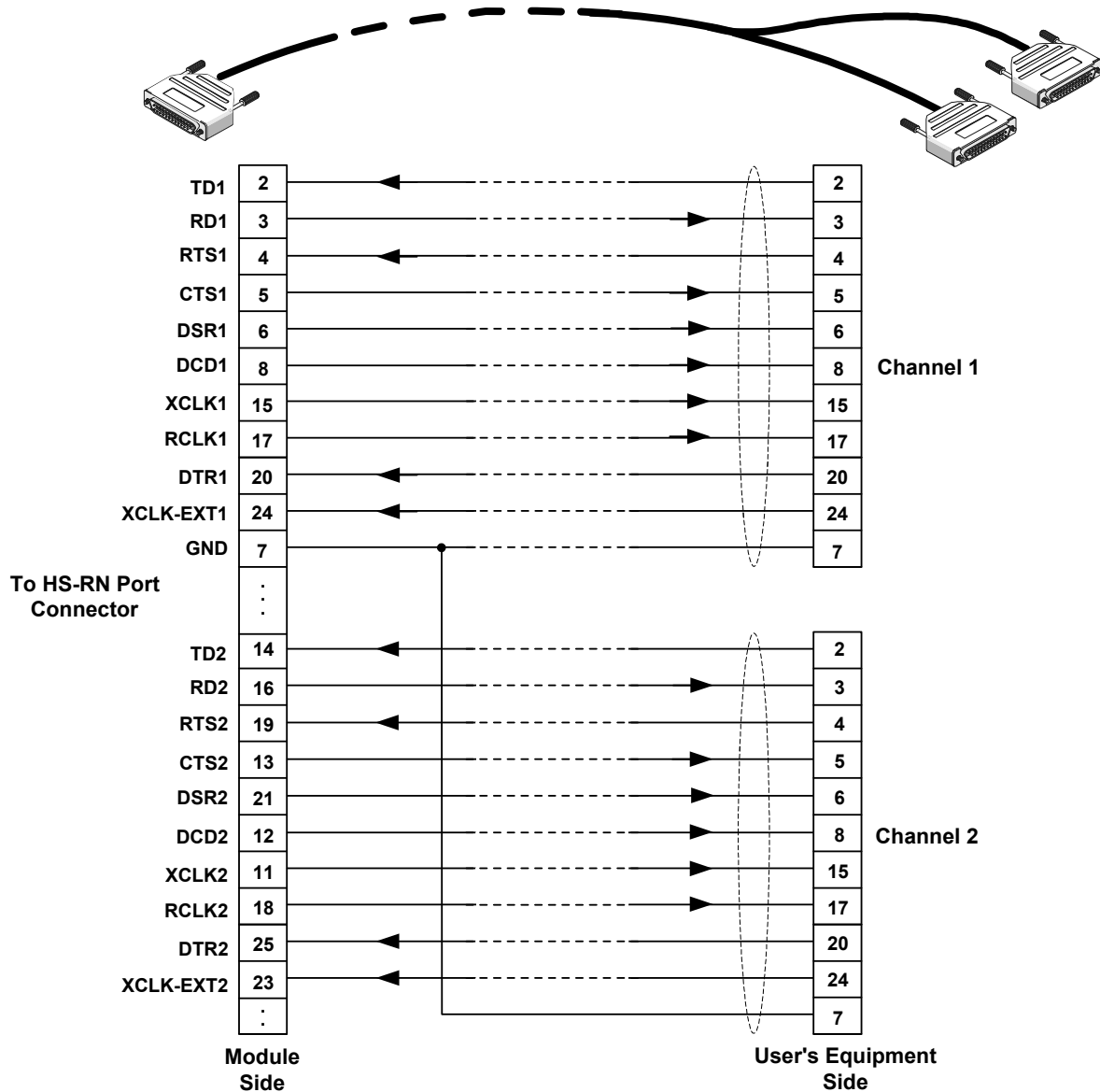


Figure 2-1. Channel Splitter Cable Wiring

Cable Connections

► To connect the cables:

1. Identify the cables intended for connection to each module connector and connect them into the appropriate connectors.

2. When using any of the adapter cables, plug each channel connector at the other end of the cable into the prescribed user's equipment connector in accordance with the site installation plan.

2.4 Normal Indications

The status of each HS-RN channel is indicated by a separate set of indicators. The normal indications for an operational channel interface are as follows:

- The LOS indicator must be off.
However, it lights up when the corresponding channel loses synchronization to the HDLC or V.110 frames used by the rate adaptation protocol (received from the remote end).

Note *When the channel operates at 56 or 64 kbps, no framing is used, and thus the LOS indicator lights only when the Megaplex main link loses synchronization.*

- The TST indicator must be off, but may turn on when a loopback is activated on the corresponding channel interface.

Chapter 3

Configuration

3.1 Introduction

This chapter provides configuration information for HS-RN modules installed in the Megaplex-2100/2104 or Megaplex-4100 chassis. For general instructions and additional configuration procedures, refer to the [Megaplex-2100/2104 Installation and Operation Manual](#) and [Megaplex-4100 Installation and Operation Manual](#), respectively.

The configuration is performed by means of the management system used to control the Megaplex unit:

- Supervision terminal or Telnet – refer to the [Megaplex-2100/2104 Installation and Operation Manual](#) or [Megaplex-4100 Installation and Operation Manual](#) for instructions.
- Web browser – refer to the [Megaplex-4100 Installation and Operation Manual](#) for instructions.
- Network management system, e.g., the RADview network management system – refer to the [RADview User's Manual](#) for instructions.

3.2 Configuration Sequence for the MP-2100/2104 Chassis

➤ To configure an HS-RN module and put it into service:

1. Add an HS-RN module not yet installed in the Megaplex-2100/2104 chassis to the database. This allows preconfiguring the module parameters, so that the module will immediately start operating in the desired mode as soon as it is installed in the enclosure. For the supervision terminal, use the DEF SYS command.
2. Configure the HS-RN channel parameters:
 - To define the parameters of all the module channels on the supervision terminal, type the command:

```
DEF CH SS *
```

- To define the parameters of a desired channel on the supervision terminal, type the command:

```
DEF CH SS CC
```

where SS is the slot number, and CC is the channel number (1 to 4). For the parameter description, see [Table 3-1](#).

Note *HS-RN modules are identified as **HS-R** by the Megaplex-2100/2104 management system, including the supervisory terminal.*

3. Configure the rate of each module port by assigning timeslots as described in [Section 3.5](#).

Note *Make sure to plan ahead the configuration sequence, because Megaplex-2100/2104 databases can be updated only after correctly completing the configuration activities: any sanity error will prevent saving the changes to the database being modified.*

3.3 Configuration Sequence for the MP-4100 Chassis

➤ To configure an HS-RN module and put it into service:

1. Add an HS-RN module not yet installed in the Megaplex-4100 chassis to the database. This allows preconfiguring the module parameters, so that the module will immediately start operating in the desired mode as soon as it is installed in the enclosure.

For the supervision terminal, use the **Configuration > System > Card Type** screen.

2. Configure the CL or M8E1/M8T1 module port parameters (depending on the HS-RN module application). For the configuration procedure, refer to the appropriate Installation and Operation Manual.
3. Configure the HS-RN port parameters. For the supervision terminal, use the **Configuration > Physical Layer > I/O** screen.
4. Configure the timeslot assignment of each module port, using the **Configuration > System > TS Assignment** screen.

Note *Make sure to plan ahead the configuration sequence, because Megaplex-4100 databases can be updated only after correctly completing the configuration activities: any sanity error will prevent saving the changes to the database being modified.*

3.4 Configuration Parameters

Each HS-RN channel (external port) can be independently configured in accordance with the system requirements.

[Table 3-1](#) explains the programmable parameters of the HS-RN channels, and their ranges of values.

Table 3-1. Channel Parameters

Parameter	Function	Values	
Connect (MP-2100/2104 only)	Determines whether the channel is connected to the internal TDM buses of the Megaplex chassis	NO	The channel is disconnected. You can still program the desired parameters, so the channel will be ready to operate when needed.
		YES	The channel is connected to a legacy main link port, and can carry traffic.
		Default: NO	
Admin Status (MP-4100 only)	Used to enable/disable the flow of traffic through the selected port	UP	The flow of traffic is enabled.
		DOWN	The flow of traffic is disabled. This state should be selected as long as the port configuration has not yet been completed, or when it is necessary to stop traffic flow through the port.
		Default: DOWN	
Bus Connection (MP-2104/2100 only)	<p>Selects the number of TDM buses that can be used by the module.</p> <p>This parameter is relevant only in Megaplex units with CL.2 modules running software version 11.0 or higher; otherwise, only two TDM buses (buses A or B) can be used, and all the HS-RN channels are routed to the same bus.</p> <p>The selection made for one channel is automatically applied to all the channels (the last selection overrides all prior selections).</p> <p>The selected number cannot exceed the number of the TDM buses selected by means of the SET USER command</p>	FULL	All the four TDM buses can be used.
		PARTIAL	The module can use only two buses (either bus A or B), even if the number of TDM buses selected by means of the SET USER command is greater.
		Default: PARTIAL	
Encapsulation Mode	<p>Controls the encapsulation mode according to the user application in the HDLC model.</p> <p>The V.110 model operates in Bandwidth Optimized mode only, but the end-to-end data latency is at minimum.</p>	Bandwidth Optimized – enables uplink bandwidth optimization (using split timeslots) in applications less sensitive to latency.	
		Latency Optimized – enables minimum end-to-end data latency. In this mode split timeslots are not available and the uplink bandwidth should be always transferred over full 64 kbps timeslots.	
		Default: Bandwidth Optimized	
Format	Specifies the channel operating mode	ASYNC	Asynchronous mode
		SYNC	Synchronous mode
		Default: ASYNC (MP-2100), SYNC (MP-4100)	

Parameter	Function	Values
Rate	Specifies the channel data rate. Notes: 1. When Encapsulation mode is "Latency optimized", only rates up to 19.2 are supported and occupying the full timeslot bandwidth. 2. The rates marked by asterisk (*) are supported in the HDLC model only.	The range of selections is as follows: ASync mode: 0.6, 1.2, 2.4, 4.8, 7.2*, 9.6, 14.4*, 19.2, 28.8*, or 38.4 kbps. Sync mode: 0.6, 1.2, 2.4, 4.8, 7.2*, 9.6, 14.4*, 19.2, 28.8*, 38.4, 56, or 64 kbps. Default: 0.6 kbps
CTS	Used to control the state of the CTS line	The available selections are: ON The CTS line is continuously on. RTS The CTS line tracks the state of the local RTS line. Default: ON
DCD & DSR	Controls the end-to-end transmission of the local DTR and RTS lines to the remote DSR and DCD lines, respectively	LOCAL End-to-end transmission disabled, only local support available. Always use this selection for data rates exceeding 38.4 kbps. END-TO-END End-to-end transmission enabled: the state of the local RTS and DTR lines are reflected by the remote DCD and DSR line, respectively. Do not use this selection for data rates exceeding 38.4 kbps. Default: LOCAL
Data Bits*	Selects the number of data bits. This parameter is displayed only when operating in the asynchronous mode	The available selections are 5, 6, 7, or 8 bits. Default: 8 BITS (MP-4100), 5 BITS (MP-2100/2104)
Parity*	Used to control the end-to-end transfer of the parity bit. This parameter is displayed only when operating in the asynchronous mode	The available selections are: YES The parity bit is transparently transferred end-to-end. This selection is relevant only when the user's equipment generates a parity bit. NO The parity bit is not transferred. Default: NO
Stop Bits*	Used to select the number of stop bits. This parameter is displayed only when operating in the asynchronous mode	The available selections are 1 or 2 bits. Default: 1

*When setting the Async Mode parameters, pay attention to the total character length calculated by the formula: **M=data bits + parity + 1 start bit + stop bits**. This length can be set to 8,9,10, or 11. The numbers out of this range are not supported.

Parameter	Function	Values
Clock Mode	Used to control the clock mode in the synchronous mode. This parameter is displayed only when operating in the synchronous mode	<p>The available selections are:</p> <p>DCE The channel provides transmit and receive clocks to the DTE.</p> <p>EXT DCE The channel provides the receive clock to the DTE, and accepts the transmit clock from the DTE.</p> <p>Default: DCE</p>
Oper Mode	Selects the operation mode	<p>BI-DIR Bidirectional (regular) mode</p> <p>UNI-BRD TX Unidirectional broadcast transmit mode</p> <p>UNI-BRD RX Unidirectional broadcast receive mode</p> <p>BID-BRD RX Bidirectional broadcast receive mode (MP-2100/2104 only)</p> <p>Default: BI-DIR</p>
ML Slot (MP-2100/2104 only)	Selects the I/O slot number of the destination main link module	<ul style="list-style-type: none"> When using the BI-DIR, UNI-BRD RX or BID-BRD RX modes, you can select the desired I/O slot. When using the UNI-BRD TX mode, this field automatically changes to BRD, to remind you that the destination port must be selected using the DEF TS command. <p>Default: IO-1</p>
ML Channel (MP-2100/2104 only)	Selects the number of the main link port on the selected destination main link module	<ul style="list-style-type: none"> When using the BI-DIR, UNI-BRD RX or BID-BRD RX modes, you can select the desired external port number. The supported range depends on the number of external ports available on the main link module installed in the slot selected by the ML Slot parameter. When using the UNI-BRD TX mode, this field automatically changes to BRD, to remind you that the destination port must be selected using the DEF TS command. <p>Default: EX1</p>
Link to Slot (MP-4100 only)	Specifies the module (I/O slot) to which the data stream handled by the port is routed.	The available selections are the CL module installed in the chassis, and I/O modules IO-1 to IO-10.
Link to Port (MP-4100 only)	Specifies the port to which the data stream handled by the port is routed.	The available selections are 1 to 8 for external ports, or 1 to 63 (1 to 84) for internal (virtual) ports (actual range depends on the destination module).

Parameter	Function	Values
Map Type	<p>Selects the timeslot mapping method when the destination is a TDM main link or CL port.</p> <p>For a module installed in a MP-4100 chassis, this field appears only for the UNI-BRD RX mode.</p>	<ul style="list-style-type: none"> When using the BI-DIR or UNI-BRD TX mode for a module installed in a MP-2100/2104 chassis, this field automatically changes to N/A, to remind you that the destination must be selected using the DEF TS command When using the UNI-BRD RX or BID-BRD RX mode, you can select the desired mode: <ul style="list-style-type: none"> USER You can select the desired uplink timeslots on the timeslot map. SEQUENCE The external port is assigned consecutive timeslots, starting with the timeslot specified by means of the Start TS parameter. <p>Default: N/A</p>
Start TS	<p>Selects the starting timeslot in the frame of the destination TDM uplink port.</p> <p>This parameter can be selected only when using the SEQUENCE mapping mode; when using any other mode, this field automatically changes to N/A.</p> <p>For a module installed in a MP-4100 chassis, this field appears only for the UNI-BRD RX mode.</p>	<p>The allowed range is 1 to 31 for E1 ports, and 1 to 24 for T1 ports.</p> <p>Default: N/A</p>

3.5 Assigning Timeslots

After performing the configuration of the individual module channels, it is necessary to assign the uplink bandwidth to each connected channel.

- When using the **BI-DIR** or **UNI-BRD TX** mode in the module installed in the MP-2100/2104 chassis, use the **DEF TS** command to assign a timeslot or **DEF SPLIT TS A:B:C** command to assign a fraction of a timeslot as explained in the [Megaplex-2100/2104 Installation and Operation Manual](#). For the module installed in the MP-4100 chassis, use the **Configuration > System > TS Assignment** screen.
- When using the **UNI-BRD RX** or **BID-BRD RX** mode in the module installed in the MP-2100/2104 chassis, timeslot assignment for the receive direction is made using the dedicated routing fields of the **DEF CH** command. For the module installed in the MP-4100 chassis, use the **Configuration > Physical Layer > IO** screen.

Note

When using any broadcast mode or latency-optimized mode, split timeslot assignment cannot be used. In this case you must assign a full timeslot to each HS-RN channel operating in this mode.

3.6 Displaying Status and Configuration Information

The **Megaplex-2100/2104** user can read the HS-RN status and configuration information using the **DSP ST CH** command. For a general description of this command, refer to [Appendix F](#) of the *Megaplex-2100/2104 Installation and Operation Manual*.

The **DSP ST CH** command includes two sections:

- **Hardware Config/Status:** displays the module type: **V.110** or **HDLC**.
- **Software Configuration:** displays a data form similar to that displayed by the **DEF CH** command, showing the current configuration of each channel. For a description of the displayed parameters, refer to [Table 3-1](#).

The **Megaplex-4100** user can read the configuration on every port of the I/O modules using the **Configuration>Physical Layer>I/O** menu. For a general description of these menus, refer to [Chapter 4](#) of the *Megaplex-4100 Installation and Operation Manual*.

Use **Monitoring>Physical Layer>I/O** menu to display the module type (**Interface Info**) in the Megaplex-4100 chassis: **V.110** or **HDLC**.

Chapter 4

Diagnostics and Troubleshooting

This chapter explains the specific diagnostic functions of the HS-RN modules and provides troubleshooting information.

For a description of the alarm and configuration ("sanity") error messages generated by HS-RN module, refer to [Appendix B](#) of the *Megaplex-2100/2104 Installation and Operation Manual* or [Chapter 6](#) of the *Megaplex-4100 Installation and Operation Manual*.

The diagnostic information presented in this chapter supplements the general diagnostics and troubleshooting information instructions contained in the corresponding *Megaplex Installation and Operation Manual*.

4.1 Test and Diagnostic Functions

The available test and diagnostics functions are:

- Local digital loopback on the desired module channel.
- Remote digital loopback on the desired module channel.

The following sections describe the available test activities.

Local Digital Loopback (Local Loop)

The local digital loopback is performed at the input of the digital circuits serving the corresponding channel.

When the loopback is activated, the channel transmit signal is connected to the input of the receive path, and is returned to the user's terminal equipment. The transmit signal is still sent to the remote Megaplex.

The loopback signal path is shown in [Figure 4-1](#).

Remote Digital Loopback (Remote Loop)

The remote digital loopback is performed at the receive output of the channel receive path, by connecting the digital signal received from the main link to the input of the channel digital transmit path.

When the loopback is activated, the digital receive signal remains connected to the input of the receive path, and is returned toward the remote end.

The loopback signal path is shown in *Figure 4-2*.

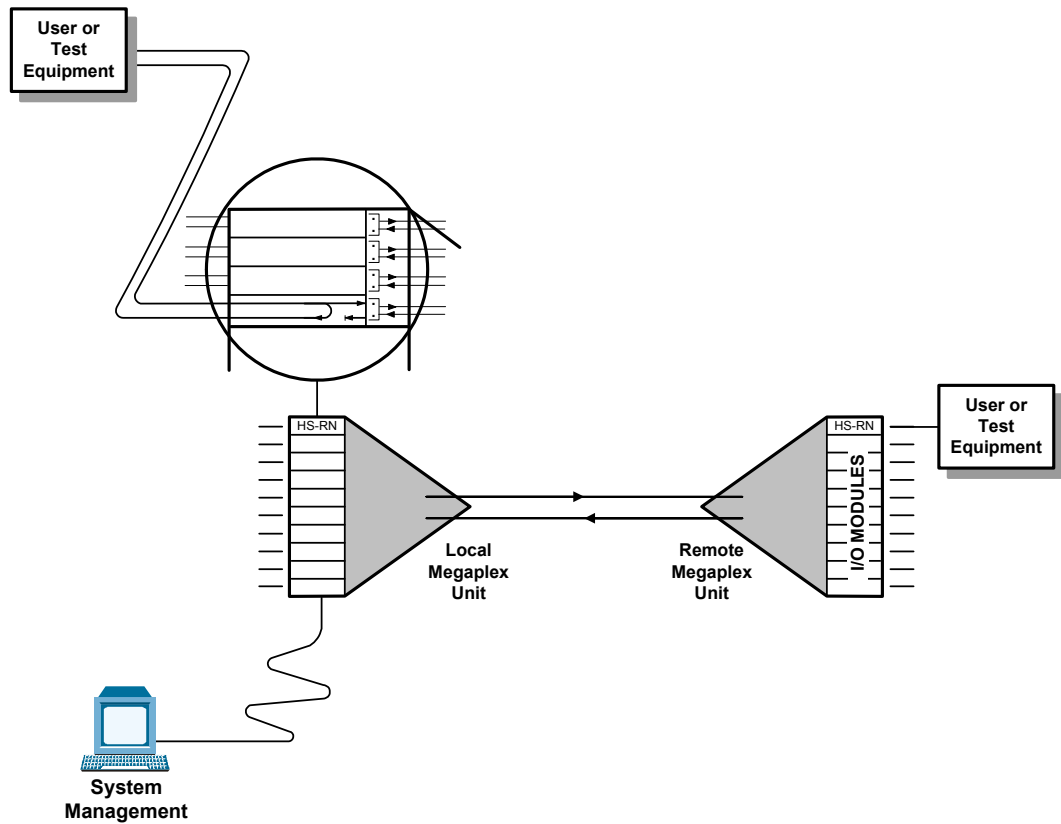


Figure 4-1. Local Digital Loopback, Signal Path

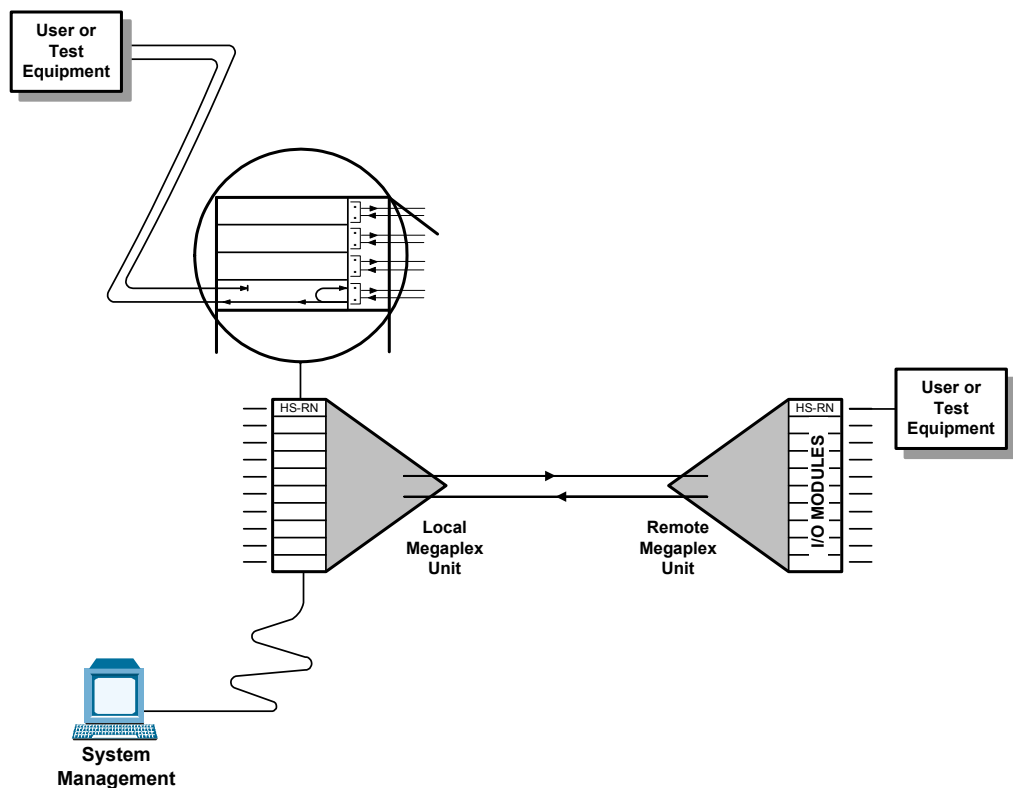


Figure 4-2. Remote Digital Loopback, Signal Path

4.2 Troubleshooting

The loops available on the HS-RN module provide a rapid and efficient way to identify the general location of a fault either of the HS-RN modules connected in a link, in the external equipment, or in the connections to the channels.

If the LOS indicator of an HS-RN channel lights, or a complaint is received regarding the transmission of data through one of the HS-RN channels, perform the following procedure until the problem is located. After each step, continue to the next step only if the previously specified test has been successfully completed.

Note

If the problem is detected when a connection between two new users is activated for the first time, before starting the troubleshooting procedure described below thoroughly check the timeslot allocation, the configuration of the two Megaplex units that provide the new connection, and the configuration of the user's terminal equipment.

- Request the user to perform a local loopback test on the local data equipment. If the user equipment does not receive its own signal, the problem is in the user equipment. After correcting the problem, continue troubleshooting as explained below.
- If the signal is not received when the remote digital loopback is activated, activate the local main link loop on the local Megaplex unit:
 - If the user equipment does not receive its own signal when the main link loop is connected, the problem is in the local unit.
 - If the signal is received when the main link local loopback is activated, activate the remote main link loop.
If the user equipment does not receive its own signal, the problem is either in the timeslot allocation, or in the remote unit.

4.3 Frequently Asked Questions

- Q** When installed in the MP-4100 chassis, do the HS-RN modules operate exactly the same as when installed in the MP-2100/2104 chassis?
- A** Yes, they do. All the differences between the two module locations are purely chassis/common logic related (command line vs menu interface, main link vs CL.1 or I/O ports as timeslot destinations, etc). The main module-level difference is that the bidirectional broadcast mode (BID-BRD RX) is not available for the module operating in the Megaplex-4100 chassis.

- Q** Which RS-232 pins are involved in HS-R/HS-RN end-to-end control signals transfer?
- A** HS-R/HS-RN modules support the following end-to-end signals transfer:
- DTR to DSR
 - RTS to DCD

4.4 Technical Support

Technical support for this product can be obtained from the local distributor from whom it was purchased.

For further information, please contact the RAD distributor nearest you or one of RAD's offices worldwide. This information can be found at www.rad.com (offices – About RAD > Worldwide Offices; distributors – Where to Buy > End Users).

Customer Response Form

RAD Data Communications would like your help in improving its product documentation. Please complete and return this form by mail or by fax or send us an e-mail with your comments.

Thank you for your assistance!

Manual Name: HS-RN

Publication Number: 764-207-12/08

Please grade the manual according to the following factors:

	<i>Excellent</i>	<i>Good</i>	<i>Fair</i>	<i>Poor</i>	<i>Very Poor</i>
Installation instructions	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
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What did you like about the manual?

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Type of error(s) or problem(s):

- ☐ Incompatibility with product
- ☐ Difficulty in understanding text
- ☐ Regulatory information (Safety, Compliance, Warnings, etc.)
- ☐ Difficulty in finding needed information
- ☐ Missing information
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- ☐ Appearance
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Please list the exact page numbers with the error(s), detail the errors you found (information missing, unclear or inadequately explained, etc.) and attach the page to your fax, if necessary.

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